NYU

# MATH-UA 122: Calculus II

## Professor Ross Flek - Fall 2024

## Worksheet #1 – Review of Integration

#1 – #5: Evaluate the indefinite integrals.

1. $\displaystyle\int \frac{10x^2 - 3x + 1}{\sqrt{x}}\, dx$

2. $\displaystyle\int \left(\frac{\sqrt{x}}{2} + \frac{2}{\sqrt{x}}\right) dx$

3. $\displaystyle\int \left(2 + \tan^2 x\right) dx$

4. $\displaystyle\int \cos t(\tan t + \sec t)\, dt$

5. $\displaystyle\int \frac{\csc\theta}{\csc\theta - \sin\theta}\, d\theta$

6. Determine if the following formulas are correct. Give a reason for each answer.

(a) $\displaystyle\int x\sin x\ dx = -x\cos x + C$

(b) $\displaystyle\int x\sin x\ dx = -x\cos x + \sin x + C$

(c) $\displaystyle\int \tan\theta\sec^2\theta\ d\theta = \frac{\sec^3\theta}{3} + C$

(d) $\displaystyle\int \tan\theta\sec^2\theta\ d\theta = \frac{1}{2}\tan^2\theta + C$

(e) $\displaystyle\int \tan\theta\sec^2\theta\ d\theta = \frac{1}{2}\sec^2\theta + C$

(f) $\displaystyle\int \sqrt{2x+1}\ dx = \frac{1}{3}\left(\sqrt{2x+1}\right)^3 + C$

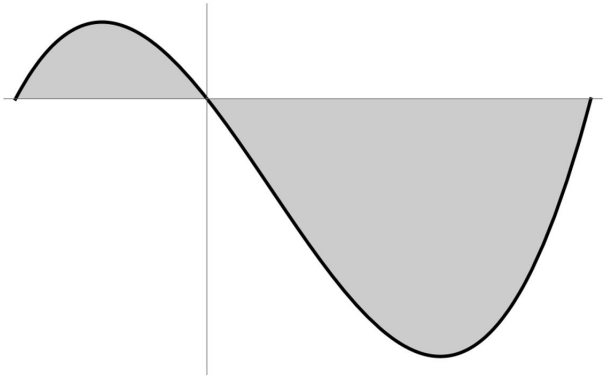
#7 – #9: Evaluate the definite integrals.

7. $\displaystyle\int_1^4 \left(\frac{2}{\sqrt{x}} - x\right) dx$

8. $\displaystyle\int_0^{\frac{\pi}{4}} (\sec x + \tan x)^2 \, dx$

9. $\displaystyle\int_0^1 x\sqrt{3x} \, dx$

10. Find the total area of the region between the $x$-axis and the graph of $f(x) = x^3 - x^2 - 2x$ over the interval $-1 \leq x \leq 2$



11. Find the derivative below by (a) evaluating the integral and differentiating the result, and then by (b) differentiating the integral directly:

$$\frac{d}{dt}\int_0^{t^4} \sqrt{u}\, du$$

12. Find the derivative below by (a) evaluating the integral and differentiating the result, and then by (b) differentiating the integral directly:

$$\frac{d}{dx}\int_0^{\tan x} \frac{dt}{1+t^2}, \quad -\frac{\pi}{2} < x < \frac{\pi}{2}$$

13. Find the area of the shaded region: